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IS 8872-2-2 (1979): Variable resistors, Part 2: General purpose, Section 2: Type VRG 2C [LITD 5: Semiconductor and Other Electronic Components and Devices]

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UDC 621·316·82 : 621·38·038

IS : 8872 (Part II/Sec 2) - 1979

(Reaffirmed 2002)

Indian Standard

SPECIFICATION FOR VARIABLE RESISTORS

PART II GENERAL PURPOSE

Section 2 Type VRG2C

Resistors Sectional Committee, LTDC 14 [Ref : Doc : LTDC 14 (300)]

0. General — This standard shall be read in conjunction with IS : 8872 (Part I) - 1977 'Specification for variable resistors: Part I General requirements and methods of tests'.

1. Scope — Covers non wire-wound, general purpose variable resistors of sliding motion type required for commercial applications.

2. Outline Drawing and Dimensions — The outline drawing and dimensions shall be according to Fig. 1 and Table 1.

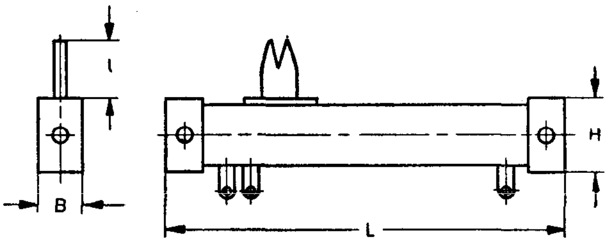

FIG. 1 OUTLINE DRAWING AND DIMENSIONS

TABLE 1 DIMENSIONS AND MECHANICAL CHARACTERISTICS

[*Clauses* 2 *and* 3 (a), and *Table* 5]

Style	Dimensions, mm				Total Mechanical Travel	Operating Force	End Stop Force
	L *Max*	*B* *Max*	*H* *Max*	*l* + 0·3			*Max*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
					mm	N	N
VRG2C - 0·4A	90	16	16	12·5	57·2 ± 0·5	0·75 – 2·0	50
VRG2C - 0·25A	70	10	16	12·5	39·2 ± 0·5	0·75 – 2·0	50
VRG2C - 0·2B	90	16	16	12·5	57·2 ± 0·5	0·75 – 2·0	50
VRG2C - 0·125B	70	10	16	12·5	39·2 ± 0·5	0·75 – 2·0	50

3. Ratings and Characteristics

a) Mechanical characteristics	*See* Table 1
b) Electrical ratings	*See* Table 2
c) Selection tolerance	± 20 percent
d) Stability class:	
1) Electrical	± 10 percent
2) Mechanical	± 25 percent
e) Temperature characteristic of resistance	± 1 200 ppm/°C
f) Maximum surface temperature	100°C
g) Mechanical endurance	10 000 cycles
h) Typical construction	Carbon composition, unsealed with sliding motion

Adopted 12 July 1979

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Price Rs 8·00

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

TABLE 2 ELECTRICAL RATINGS

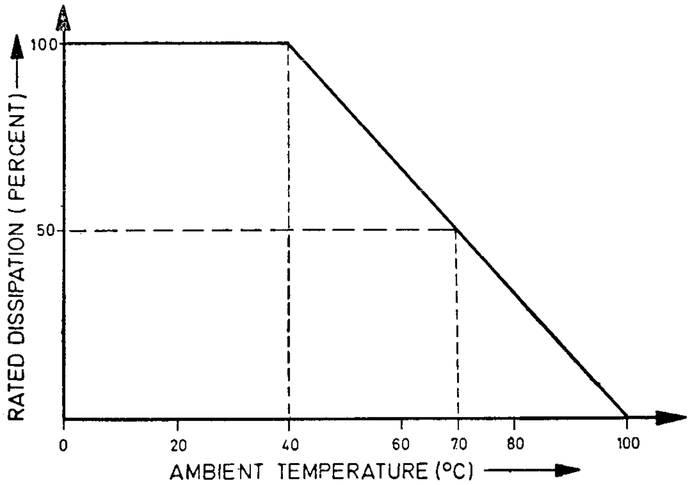
[*Clause* 3(b)]

Style	Rated Dissipation at 40°C	Resistance Range (E3 Series)	Resistance Law	Rated Limiting Element Voltage V_{dc} or V_{rms}	Total Electrical Travel
(1)	(2)	(3)	(4)	(5)	(6)
	W				mm
VRG2C - 0·4A	0·4	220 Ω to 4·7 M Ω	Law A (linear)	250	55 ± 1
VRG2C - 0·25A	0·25	220 Ω to 4·7 M Ω	Law A (linear)	250	37 ± 1
VRG2C - 0·2B	0·2	1 K Ω to 4·7 M Ω	Law B (forward log)	250	55 ± 1
VRG2C - 0·125B	0·125	1 K Ω to 4·7 M Ω	Law B (forward log)	250	37 ± 1

4. Climatic Severities

a) Temperature severity	– 10 to + 70°C
b) Damp heat severity	21 days
c) Bump	4 000, 10 g
d) Vibration	10-55 Hz, 10 g, 3 × 2 h
e) Shock	Not applicable
f) Acceleration	Not applicable
g) Low air pressure	Not applicable
h) Rapid change of temperature	Not applicable

5. Derating — Variable resistors covered by this standard are derated linearty from 100 percent rated dissipation at 40°C to zero dissipation at 100°C through 50 percent dissipation at 70°C. The dissipation at temperatures below 40°C is the rated dissipation. Reference should be made to curve shown below to find out the dissipation at other temperatures.



6. Marking — *See* **6** of IS : 8872 (Part I) - 1977.

7. Material, Construction and Workmanship — *See* **5** of IS : 8872 (Part I) - 1977.

8. Tests

8.1 *Classification of Tests*

8.1.1 *Type tests* — The procedure for type approval shall be in accordance with IS : 2612 - 1965 'Recommendation for type approval and sampling procedures for electronic components'. The sequence of type tests and grouping of samples for type approval shall be in accordance with Table 3.

TABLE 3 TYPE TESTS

(*Clause* 8.1.1)

Sl No.	Title of Test	Number of Samples			Clause Ref in IS : 8872 (Part I)-1977
		Highest Value	Middle Value	Lowest Value	
(1)	(2)	(3)	(4)	(5)	(6)
i)	*Group 0*				
a)	Visual examination	16	16	16	9.1
b)	Dimensions				9.1.1
c)	Electrical continuity				8.1
d)	Total resistance				8.2
e)	Terminal resistance				8.3
f)	Attenuation				8.4
g)	Effective resistance and angle of effective rotation				8.6
h)	Resistance law				8.7
j)	Matching of resistance law (for tandem types only)				8.14
k)	Switch contact resistance (for types with switch only)				8.8
m)	Voltage proof				8.9
n)	Insulation resistance				8.10
p)	Noise				8.12
q)	Operating torque				9.2
r)	Switching torque				9.3
s)	End-stop torque				9.4
t)	Locking torque				9.5
u)	Thrust and pull on spindle				9.6
ii)	*Group 1*				
a)	Robustness of terminations	4	4	4	9.7
b)	Solderability				9.8.3
c)	Bump				9.10
d)	Vibration				9.9
e)	Climatic sequence				10.1
iii)	*Group 2*				
	Damp heat (long term)	2	2	2	10.2
iv)	*Group 3*				
	Mechanical endurance	2	2	2	11.3
v)	*Group 4*				
	Electrical endurance	2	2	2	11.4
vi)	*Group 5*				
	Resistance to soldering heat	2	2	2	9.8.4
vii)	*Group 6*				
	Temperature characteristic of resistance	2	2	2	8.11
Spares		2	2	2	—

8.1.1.1 *Number of samples* — The manufacturer shall submit for each rated dissipation, the number of samples as given below:

Highest value	16*
Middle value	16*
Lowest value	16*

8.1.2 *Routine tests* — The following tests shall be carried out on each and every variable resistor:

a) Visual examination,
b) Electrical continuity, and
c) Total resistance.

8.1.2.1 If during routine tests, more than 10 percent of the lot fails, the entire lot may be rejected.

8.1.3 *Acceptance tests* — For the purpose of the acceptance of the lot, all the resistors shall be subjected to the tests as given in **8.1.2**. Following this two groups of samples (Groups A and B) shall be selected (*see* Appendix B of IS : 2612-1965 Recommendation for type approval and sampling procedures for electronic components) and the resistors shall be subjected to the tests specified in Table 4.

TABLE 4 ACCEPTANCE TESTS

Sl No.	**Tests**	**Clause Ref in IS : 8872 (Part I)-1977**	**AQL* (Percent Defective)**	**Inspection Level**	**D/ND**
(1)	(2)	(3)	(4)	(5)	(6)
i)	*Group* ***A***		1 percent	II	
	a) Dimensions	9.1.1			
	b) Resistance law	8.7			
	c) Voltage proof (two seconds duration)	8.9			
	d) Operating force	9.2			
	e) Noise	8.12			
ii)	*Group B*				
	Subgroup B_1		4 percent	S3	ND
	a) Solderability	9.8.3			
	Subgroup B_2		4 percent	S3	D
	a) Resistance to soldering heat	8.8.4	—	—	—
	b) Robustness of terminations	9.7			
	c) Mechanical endurance	11.3			
	d) End stop force	9.4			
	Subgroup B_3		4 percent	S3	D
	a) Vibration	8.9			
	b) Climatic sequence	10.1			
	Subgroup B_4		4 percent	S3	D
	a) Electrical endurance (168 h)	11.4			

D = Destructive
ND = Non-destructive

Note — For each subgroup, separate samples shall be drawn.

*IS : 2500 (Part I)-1973 ' Sampling inspection tables: Part I Inspection by attributes and by count of defects (*first revision*) '.

8.2 *General Conditions for Tests* — *See* **7** of IS : 8872 (Part I)-1977. The same measurement set shall be used for any one test but not necessarily for all tests.

8.2.1 The test schedule with test conditions and requirements applicable to the variable resistors covered by this standard shall be in accordance with Table 5.

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*Of these 16 samples, 14 are required for carrying out the type tests and two are to be kept as spare.

TABLE 5 TEST SCHEDULE AND REQUIREMENTS

(*Clause* 8.2.1)

<table>
<tr><th>Sl No.</th><th>Test</th><th>Clause Ref in IS : 8872 (Part I)-1977</th><th>Condition of Test</th><th>Requirement</th></tr>
<tr><td>(1)</td><td>(2)</td><td>(3)</td><td>(4)</td><td>(5)</td></tr>
<tr><td>i)</td><td><i>All samples</i></td><td></td><td></td><td></td></tr>
<tr><td></td><td>a) Visual examination</td><td>9.1</td><td>—</td><td>Workmanship, and finish shall be satisfactory, marking shall be legible</td></tr>
<tr><td></td><td>b) Dimensions</td><td>9.1.1</td><td>—</td><td>The dimensions of the resistors shall conform to the values specified in Table 1 read with Fig. 1</td></tr>
<tr><td></td><td>c) Electrical continuity</td><td>8.1</td><td>—</td><td>There shall be no electrical discontinuity</td></tr>
<tr><td></td><td>d) Total resistance</td><td>8.2</td><td>—</td><td>The resistance value at 25°C shall correspond with the rated resistance taking into account the tolerance</td></tr>
<tr><td></td><td>e) Terminal resistance</td><td>8.3</td><td>—</td><td>The minimum terminal resistance at either end of the variable resistor shall not exceed the values specified in Table 6</td></tr>
<tr><td></td><td>f) Attenuation (for Law B variable resistor having values $>1\text{k}\Omega$ only)</td><td>8.4</td><td>—</td><td>Shall be greater than 50 dB</td></tr>
<tr><td></td><td>g) Resistance law</td><td>8.7</td><td>Moving contact setting in percent of total electrical travel:
Law A 45 to 53
Law B i) 30 to 36
ii) 64 to 76</td><td>Output resistance ratio (percent) shall not exceed the limits:
Law A 40 to 60
Law B i) 1·5 to 8
ii) 10 to 40</td></tr>
<tr><td></td><td>h) Matching of resistance law (for tandem types only)</td><td>8.14</td><td>—</td><td>The ratio of the two voltages or the difference expressed in decibels shall be within the limits given below:
Law A
At any point between 10 percent and 90 percent of the total resistance value, the momentary ratio $\frac{Vab}{Vac}$ or $\left(\frac{Vcb}{Vac}\right)$ of either of the two sections shall not exceed 1·25 times the corresponding momentary ratio of the other section.
Law B
<table>
<tr><th>Attenuation $\left(20 \log \frac{Vac}{Vab}\right)$</th><th>Maximum Permissible Difference</th></tr>
<tr><td>0 - 20 dB</td><td>2 dB</td></tr>
<tr><td>20 - 30 dB</td><td>3 dB</td></tr>
<tr><td>30 - 40 dB</td><td>4 dB</td></tr>
<tr><td>Over 40 dB</td><td>No requirements</td></tr>
</table>
</td></tr>
</table>

(*Continued*)

TABLE 5 TEST SCHEDULE AND REQUIREMENTS — *Contd*

Sl No.	Test	Clause Ref in IS : 8872 (Part I)-1977	Condition of Test	Requirement
(1)	(2)	(3)	(4)	(5)
	j) Voltage proof	8.9	Test voltage of 1 000 V at 50 Hz shall be applied for 1 min ± 5 s between solder tags strapped together and metal cover	The resistor shall withstand the test without breakdown or flash over
	k) Insulation resistance	8.10	—	10 000 MΩ *Min*
	m) Contact resistance variation	8.12.4	—	The contact resistance variation value shall not exceed 6 percent of R_n for Law A and 8 percent of R_n for Law B variable resistors
	n) Operating force	9.2	—	—
	p) End stop force	9.4	The adjuster shall be set against each end stop in turn and the force to be applied for 5 s	There shall be no visible damage when a load of maximum 5 kg is applied
	q) Thurst and pull on adjuster	9.6	—	—
	1) Visual examination	9.1	—	There shall be no visible damage
	2) Electrical continuity	8.1	—	There shall be no electrical discontinuity
	3) Total resistance	8.2	—	The change in resistance value shall not exceed ± 2 percent
ii)	*First Group*			
	a) Robustness of terminations	9.7	—	There shall be no damage
	b) Solderability	9.8.3	—	—
	Visual examination	9.1	—	There shall be no damage
	c) Bump	9.10	—	—
	1) Visual examination	9.1	—	There shall be no damage
	2) Total resistance	8.2	—	Change in resistance value shall not exceed ± 2 percent
	d) Vibration	9.9	—	—
	1) Visual examination	9.1	—	There shall be no damage
	2) Total resistance	8.2	—	Change in resistance value shall not exceed ± 2 percent
	e) Climatic sequence	10.1		—
	1) Dry heat	10.1.2	At upper category temperature (+ 70°C)	
	Visual examination	9.1		There shall be no damage
	2) Damp heat (accelerated) first cycle	10.1.3	One cycle of 24 h at 55 ± 2°C and R. H. of 95 - 100 percent with no voltage applied	—
	Visual examination	9.1		There shall be no damage
	3) Cold	10.1.4	—	—
	i) Visual examination	9.1	—	There shall be no damage
	ii) Operating force	9.2	—	As in Table 1
	4) Damp heat (accelerated) remaining cycles	10.1.6	One cycle	—
	i) Visual examination	9.1	—	There shall be no damage
	ii) Total resistance	8.2	—	The change in resistance value shall not exceed ±20 percent
	iii) Insulation resistance	8.10	—	25 MΩ, *Min*
	iv) Electrical continuity	8.1	—	There shall be no electrical discontinuity

(*Continued*)

TABLE 5 TEST SCHEDULE AND REQUIREMENTS — *Contd*

Sl No.	Test	Clause Ref in IS : 8872 (Part I)-1977	Condition of Test	Requirement
(1)	(2)	(3)	(4)	(5)
	v) Operating force	8.2	—	As in Table 1
	vi) Voltage proof	8.9	—	There shall be no breakdown or flashover
	vii) Insulation resistance	8.10	After further recovery period of 24 hours	Initial value
iii)	*Second Group*			
	a) Damp heat (long term)	10.2	Half the number of specimens shall be loaded with direct voltage of 20 V between the movable contact and case (movable contact being positive)	—
	i) Visual examination	9.1	—	There shall be no damage
	ii) Total resistance	8.2	—	The change of resistance value shall not exceed ± 20 percent
	iii) Insulation resistance	8.10	—	25 MΩ, *Min*
	iv) Continuity	8.1	—	There shall be no electrical discontinuity
	v) Starting force	9.2	—	As in Table 1
	vi) Contact resistance variation	8.12.4	—	The contact resistance variation value shall not exceed 6 percent of R_n for Law A and 8 percent of R_n for Law B variable resistance
	vii) Voltage proof	8.9	—	There shall be no break down or flashover
iv)	*Third Group*			
	Mechanical endurance	11.3	10 000 cycles	—
	a) Visual examination	9.1	—	There shall be no damage
	b) Total resistance	8.2	—	The change in resistance value shall not exceed ± 25 percent
	c) Terminal resistance	8.3	—	As in Table 6
	d) Insulation resistance	8.10	—	10 000 MΩ, *Min*
	e) Operating force	9.2	—	As in Table 1
	f) Electrical continuity	8.1	—	There shall be no discontinuity electrical
	g) Thrust and pull	9.6	—	—
	h) Voltage proof	8.9	—	There shall be no breakdown or flashover
	j) Contact resistance variation	8.12.4	—	The contact resistance variation value shall not exceed 6 percent of R_n for Law A and 8 percent of R_n for Law B variable resistance
v)	*Fourth Group*			
	a) Endurance (electrical)	11.4	—	—
	i) Visual examination	9.1	—	There shall be no damage
	ii) Total resistance	8.2	—	Change in resistance value shall not exceed ±10 percent
	iii) Insulation resistance	8.10	—	10 000 MΩ, *Min*
	iv) Contact resistance variation	8.12.4	—	The contact resistance variation value shall not exceed 6 percent of R_n for Law A and 8 percent of R_n for Law B variable resistance
vi)	*Fifth Group*			
	Resistance to soldering heat	9.8.4	—	—
	a) Visual examination	9.1	—	There shall be no damage
	b) Total resistance	8.2	—	The change in resistance value shall not exceed ±2 percent
	c) Terminal resistance	8.3	—	As in Table 6
vii)	*Sixth Group*			
	Temperature characteristic of resistance	8.11	—	± 1 200 ppm/°C

TABLE 6 MINIMUM TERMINAL RESISTANCE

[Table 5, Items (i) (e), (iv) (c) *and* (vi) (c)]

Sl No.	Rated Resistance (ohms)		Maximum Value of Minimum Resistance (ohms)		
	Greater Than	Less Than or Equal to	Clockwise and Counter Clockwise	Counter Clockwise	Clockwise
			Law A	Law B	Law B
(1)	(2)	(3)	(4)	(5)	(6)
i)	—	500	10	—	—
ii)	500	1 K	25	25	100
iii)	1 K	5 K	25	25	100
iv)	5 K	10 K	35	35	250
v)	10 K	25 K	35	35	250
vi)	25 K	50 K	35	35	500
vii)	50 K	0·1 M	100	50	2·5 K
viii)	0·1 M	0·25 M	125	50	2·5 K
ix)	0·25 M	0·5 M	250	100	5 K
x)	0·5 M	1 M	1 M	500	25 K
xi)	1 M	2·5 M	2·2 K	500	25 K
xii)	2·5 M	5 M	4·7 K	1 K	50 K

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